

UPPER CRETACEOUS MICROPLANKTON FROM THE BELFAST
No. 4 BORE, SOUTH-WESTERN VICTORIA

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Abstract

11 species of microplankton are recorded from the lower section of the Belfast No. 4 Bore. One new genus and 5 new species are described. The age of the deposits is discussed with the conclusion that they are Upper Cretaceous, probably Senonian.

Introduction

The occurrence of Cretaceous deposits in the lower section of the Belfast No. 4 Bore drilled by the Mines Department of Victoria near Port Fairy was recently recorded by Kenley (1958-59). Although at the time of publication a more precise dating was said to be difficult, Kenley pointed out that the shelly fossils and ammonites preserved in the core between 4,645 and 4,655 ft favoured an Upper rather than a Lower Cretaceous age.

Through the generosity of the Chief Geologist, Dr D. E Thomas, one of us (I.C.C.) was enabled to examine the microplankton content of a black ammonite-containing siltstone from 4,652 ft and a mudstone between 4,492 and 4,499 ft. The examination was conducted with a view to establishing a closer age approximation by correlation with dated deposits which, elsewhere in Australia, contain distinctive microplankton assemblages.

The total microplankton content of these beds is fairly high but the number of individual types present is relatively small. However, some of these appear to have sufficiently restricted vertical distribution in other areas to confirm the Upper Cretaceous age postulated by Kenley and, in addition, to suggest that the sediments examined are probably Senonian.

In addition to microplankton there is a considerable amount of woody tissue and a relatively high percentage of pollen grains and spores. Some of the pollen grains are dicotyledonous types; this suggests that the containing sediments are unlikely to be Lower Cretaceous. The pollen and spore content of the Belfast No. 4 Bore as a whole is being studied by Mr John Douglas of the Mines Department.

Systematic Descriptions

DINOFLAGELLATES

Family GYMNODINIDAE

Genus *Gymnodinium* Stein 1878

Gymnodinium westralium, Cookson and Eisenack

Gymnodinium cf. *heterocostatum* Oeflandre and Cookson 1955, *Aust. J. Mar. Freshw. Res.* 6: 248, Pl. 1, fig. 7.

Gymnodinium westralium Cookson and Eisenack 1958, *Proc. Roy. Soc. Vic.* 70: 25, Pl. 1, fig. 9.

A single example of this species was observed in the Belfast No. 4 deposit between 4,492 and 4,499 ft. *G. westralium* has been recorded from Upper Turonian to Senonian deposits in Western Australia (Cookson and Eisenack 1960).

Family DEFLANDREIDAE

Genus *Deflandrea* Eisenack 1938

Deflandrea tripartita Cookson and Eisenack

(Fig. 1)

Deflandrea tripartita Cookson and Eisenack 1960a, p. 2, Pl. 1, fig. 10.

D. tripartita is far from rare in the Belfast No. 4 Bore between 4,492 and 4,499 ft and at 4,652 ft. It was originally recorded from West Australian Petroleum Co.'s (Wapet) Seismic Shot Hole B 1, N. of Gingin, W.A., at 160 ft, the age of which appears to be Upper Turonian to Middle Senonian.

D. tripartita is closely similar in form to *D. cooksoni* Alberti (1959) from the Upper Senonian of Central Germany. However, the girdle, which is so clearly developed in *D. tripartita*, is not represented in *D. cooksoni*.

The Belfast specimens illustrate very clearly an apparently constant feature of the girdle noticed in the type but not mentioned in the description, namely that it is not continuous on the dorsal surface, but interrupted near both lateral margins (Fig. 1).

The ornamentation of the Belfast examples is very clearly developed and consists of minute rods rather than 'granules' as was given in the original description.

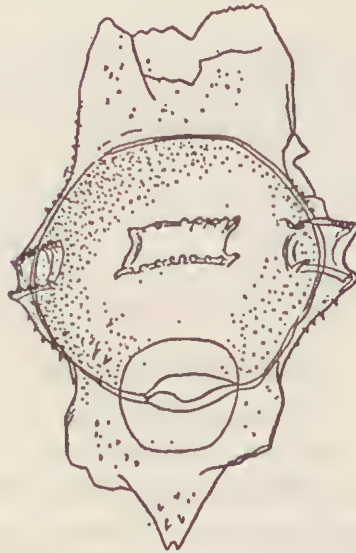


FIG. 1—*Deflandrea tripartita* Cookson and Eisenack. Belfast No. 4 Bore Vic., between 4,492 and 4,652 ft \times c. 1000.

Deflandrea cretacea Cookson

(Pl. XI, fig. 1-2)

Deflandrea cretacea Cookson 1956, p. 184, Pl. 1, fig. 1-5, non 6, 7.

The Belfast specimens show an even greater variation in size and shape than those from the type locality in the Nelson Bore, Victoria. However, there is no doubt that the 2 sets of specimens are specifically identical.

The frequent displacement of the internal body in the Belfast population, probably during fossilization, shows very clearly that the granulate to vermiculate pattern of the shell-membrane is restricted to those parts of the shell beyond the limits of the internal body.

Deflandrea belfastensis n. sp.

(Pl. XI, fig. 4-6; holotype fig. 4; Nat. Mus. Vic. P20544)

OCCURRENCE: Belfast No. 4 Bore, Vic., between 4,645 and 4,655 ft.

DESCRIPTION: Shell considerably longer than broad, sides convex in the middle region slanting slightly towards both apex and antapex. At the apex there is a short but decided bluntly-pointed horn which occasionally ends in a minute solid process which may be turned inwards. The antapex is broadly truncate or slightly concave with 2 short laterally placed, approximately equal, blunt horns. There is no indication of a girdle, longitudinal furrow or tabulation. The surface of the shell is distinctly and rather coarsely granular in the apical and antapical regions smooth in the vicinity of the internal body.

The internal body is oval to nearly circular in surface view, its longer axis being perpendicular to the longitudinal axis of the shell. It does not extend to the lateral margins of the shell but projects prominently on the ventral surface. The pylome is rather large and hoof-shaped.

DIMENSIONS: Type—length 109 μ , breadth 63 μ , internal body 48 x 56 μ . Range—length 94-120 μ , breadth 54-68 μ .

COMMENTS: This species is closely related to *D. bakeri* Deflandre and Cookson (1955). It differs from this species in (1) the narrower shape of the shell and its more sloping sides, (2) the more constant and stronger development of the apical horn, (3) the more prominent antapical horns, (4) the complete absence of a girdle which Deflandre and Cookson mention as being developed in *D. bakeri*. *D. belfastensis* is the older species and it seems likely that *D. bakeri* was derived directly from it.

D. belfastensis also seems close to *D. cretacea* Cookson. The general build and ornamentation is the same but in *D. cretacea* the apical and antapical horns are only occasionally slightly represented and the shell is considerably less elongated.

Deflandrea thomasi n. sp.

(Pl. XI, fig. 7-10; holotype fig. 8, Nat. Mus. Vic. P20545; paratype fig. 9, Nat. Mus. Vic. P21305)

OCCURRENCE: Belfast No. 4 Bore, Vic., between 4,492 and 4,499 ft.

DESCRIPTION: Shell longer than broad, roughly oval with a median girdle with low borders which, sometimes, is only indicated at the lateral margins. The epitheca has a short, solid pointed horn which terminates in a minute hyaline prominence.

their agreement in all other respects with *Canningia* is so close that little doubt is left as to their relationship with the Upper Jurassic species *C. reticulata* Cookson and Eisenack and the Lower Cretaceous species *C. colliveri* Cookson and Eisenack.

Genus *Odontochitina* Deflandre 1935

Odontochitina porifera Cookson

Odontochitina porifera Cookson 1956, p. 188, Pl. 1, fig. 17.

O. porifera occurs in the Belfast No. 4 Bore between 4,492–4,499 ft and at 4,652 ft. This species, originally described from the Nelson Bore, Vic., at 6,233 ft, has since been recorded from several Upper Cretaceous deposits in W. Australia which range in age from Upper Turonian to Santonian-Lower Maestrichtian (Cookson and Eisenack 1960).

HYSTRICHOSPHERES

Genus *Hystrichosphaeridium* Deflandre 1937

Hystrichosphaeridium heteracanthum Deflandre and Cookson

Hystrichosphaeridium heteracanthum Deflandre and Cookson 1955, p. 276, Pl. 2, fig. 5, 6, Fig. 40, 41.

H. heteracanthum has been recorded previously from Upper Cretaceous and Paleocene to Lower Eocene deposits in Victoria (Deflandre and Cookson 1955) and Upper Cretaceous deposits in W. Australia (Cookson and Eisenack 1960). It occurs in the Belfast No. 4 Bore between 4,492 and 4,499 ft and at 4,652 ft.

The shell opens as the result of a clean-cut break and the removal of a cap-like sector.

Hystrichosphaeridium complex (White)

Xanthidium tubiferum complex White 1842. *Micr. J.* 2, Pl. IV (3), fig. 11. 1844. *Trans. Micr. Soc.* 1: 83, Pl. VIII, fig. 10.

Hystrichosphaeridium elegantulum Lejeune-Carpentier 1940. *Ann. Soc. Geol. Belg.* 63: B 222, figs. 11-12.

Hystrichosphaeridium complex (White) Deflandre 1946. *C.R. Soc. Geol. Fr.* 111.

H. cf. tubiferum sec. Cookson 1953. Pl. II, fig. 24.

H. complex, originally recorded from the European Upper Cretaceous, has been observed occasionally in residues of the Belfast No. 4 sediments between 4,492 and 4,652 ft. It appears to have been widely distributed in Australian waters during both the Lower and Upper Cretaceous eras (Deflandre and Cookson 1955, Cookson and Eisenack 1958).

INCERTAE SEDIS

Genus *Hexagonifera* n. gen.

DESCRIPTION: Shell oval, wall of variable thickness, smooth or ornamented. Pylome formed by the removal of a 6-sided lid at one pole.

Type species *Hexagonifera glabra* n. sp.

COMMENTS: A comparison of *Hexagonifera* with the 2 genera *Pyxidiella* Cookson and Eisenack 1958 and *Fromea* Cookson and Eisenack 1958 shows it to be distinct from *Pyxidiella* in having a terminal instead of the sub-polar opening of this form and from *Fromea* in the presence of a distinct 'lid' and the absence of a girdle.

Hexagonifera glabra n. sp.

(Pl. XII, fig. 9-13; holotype fig 11; Nat. Mus. Vic. P20547)

OCCURRENCE: Belfast No. 4 Bore, Vic. at 4,052 ft.

DESCRIPTION: Shell thick walled, smooth, homogenous, occasionally perforated by straight narrow pores. Lid 6-sided, usually with 3 short and 3 long sides in alternation.

DIMENSIONS: Type—length 66 μ , breadth 58 μ . Range—length 62-77 μ , breadth 57-65 μ .COMMENTS: The shells of *H. glabra* have invariably shown definite signs of the suture by which the opening is made. Often the 'lid' is in position but so loosely that it becomes detached during mounting. Detached 'lids' occur frequently in our preparations. The plane along which the detachment occurs is either perpendicular or somewhat oblique to the long axis of the shell.The pores found in a few examples are reminiscent of those of *Tasmanites punctatus* Newton and *T. huronensis* (Dawson). Occasionally transparent fragments of what may possibly have been an outer membrane are attached to the shell.*Hexagonifera vermiculata* n. sp.

(Pl. XII, fig. 6-8; holotype fig. 6; Nat. Mus. Vic. P20548)

OCCURRENCE: Belfast No. 4 Bore, Vic. between 4,492 and 4,499 ft and at 4,652 ft.

DESCRIPTION: Shell oval to almost circular in outline, surface ornamented with close and rather heavy vermiculate thickenings or a small-meshed thin-walled reticuloid pattern. The lid is seldom seen in position but the 6-sided shape of the opening indicates its shape. Remains of an outer transparent membrane are sometimes present.

DIMENSIONS: Type—length 67 μ , breadth 58 μ . Range—length 56-76 μ , breadth 47-70 μ .

Conclusions

On present knowledge, 4 of the microplankton species which occur in the Belfast No. 4 Bore between 4,652 and 4,492 ft are of stratigraphical significance. They have been recorded from deposits of Upper Cretaceous age in W. Australia, which have been dated by means of foraminifera.

(1) *Deflandrea tripartita* was originally described from a carbonaceous sand at 160 ft in Western Australian Petroleum Co's (Wapet) Seismic Shot hole B 1 N. of Gingin. On the basis of microplankton correlation with deposits in Wapet's Rough Range South No. 1 Bore, the age of this deposit approximates to Upper Turonian to Middle Senonian (Cookson and Eisenack 1960).

(2) *Amphidiadema denticulata*. The type locality for this form is the deposit intersected by the Brickhouse Bore, W.A., at 455 ft; the age of which is given by Edgell (1957) at Campanian. *A. denticulata* is associated with *Deflandrea tripartita* in the carbonaceous sand at 160 and 170 ft from Wapet's Seismic Shot hole B 1. The parallel association of these 2 species in the Belfast No. 4 Bore sediments is regarded by us as especially significant and as fully supporting the Senonian age suggested herein.

(3) *Odontochitina porifera* has been recorded by Cookson and Eisenack (1960) from (a) the Upper Gearle Siltstone between 2,505 ft and 2,511 ft in Wapet's Rough Range South No. 1 Bore, the age of this horizon being determined by Dr M. F. Glaessner (unpublished report to Wapet) as Turonian; (b) the Toolonga Calcilutite between 2,393 ft and 2,447 ft in Rough Range South No. 1 Bore, Wapet geologists believe this to be of Senonian age (probably Santonian to Campanian); and (c) at 160 ft and 170 ft in Wapet's Seismic Shot hole B 1.

(4) *Hystriosphæridium heteracanthum* occurs in (1) the Toolonga Calcilutite intersected between 2,447 and 2,393 ft in the Rough Range South No. 1 Bore, this being Senonian in age (probably Santonian to Campanian); (2) the Molecap Greensand, W.A., of probable Upper Turonian to Middle Senonian age (Cookson and Eisenack 1960); and (3) Upper Cretaceous and Lower Tertiary deposits in SW. Victoria (Deflandre and Cookson 1955).

The above evidence clearly shows that (1) the Belfast No. 4 Bore sediments between 4,492 ft and 4,652 ft are Upper Cretaceous in age, as suggested by Kenley (1958-59), and (2) that they are probably Senonian.

Acknowledgements

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Addendum

As the generic names *Codonia* and *Trigonopyxis* (Cookson and Eisenack 1960a, p. 11) are preoccupied, the substitute names *Codoniella* and *Trigonopyxidid* respectively are herein proposed.

By a printer's error 'gen. and' was omitted in *Actinotheca aphroditae* gen. and sp. nov' (Cookson and Eisenack 1960a, p. 9). *Actinotheca* is a new monotypic genus. It may be diagnosed as 'shell roughly circular in outline consisting of a flat somewhat hexagonal box-like body and a broad 2-layered wing which is supported by a series of radially directed fibres'.

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Explanation of Plates

PLATE XI

- Fig. 1-2—*Deflandrea crctacca* Cookson. Fig. 1, a nearly oval form $\times c.$ 425; fig. 2, a specimen showing indication of antapical horns $\times c.$ 500.
- Fig. 3—*Amphidiadema denticulata* Cookson and Eisenack showing apical 'lid' and the pylome in the outer wall slightly out of focus $\times c.$ 700.
- Fig. 4-6—*Deflandrea belfastensis* sp. nov. Fig. 4, holotype $\times c.$ 450; fig. 5, 6, other examples $\times c.$ 500 and 400 respectively.
- Fig. 7-10—*Deflandrea thomasi* sp. nov. Fig. 7, an example without an interior body showing girdle and pylome $\times c.$ 450; fig. 8, holotype, showing antapical horns, interior body and pylome, $\times c.$ 450; fig. 9, example with a large interior body $\times c.$ 500; fig. 10, example without interior body, apical horn with small tip, girdle and pylome present $\times c.$ 450.

PLATE XII

- Fig. 1-5—*Canningia rotundata* sp. nov. Fig. 1, holotype, showing partially detached apex, apical horn with small tip and a slightly indicated antapical horn $\times c.$ 410; fig. 2, example with low, bluntly-rounded apical and antapical horns and a partially detached apex $\times c.$ 425; fig. 3, a thick-walled, strongly patterned example, with an almost circular outline and no horns $\times c.$ 465; fig. 4, example with a slightly developed apical horn and no antapical horn $\times c.$ 425; fig. 5, example with a blunt antapical horn, apical part detached, pattern faintly developed $\times c.$ 425.
- Fig. 6-8—*Hexagonifera vermiculata* sp. nov. Fig. 6, holotype in optical section, 'lid' in position, an outer layer indicated $\times c.$ 500; fig. 7, 8, optical section and surface views of another specimen.
- Fig. 9-13—*Hexagonifera glabra* sp. nov. Fig. 9, a thick-walled specimen without 'lid' showing pores in wall, $\times c.$ 500; fig. 10, a complete specimen showing distinct apical suture $\times c.$ 500; fig. 11, holotype $\times c.$ 500; fig. 12, 13, detached 'lids' $\times c.$ 500.
- Fig. 14—*Hystrichosphaeridium heteracanthum* Deflandre and Cookson open shell $\times c.$ 400.
—Eisenack photos.